

Final Panel Discussion: Food for Thought

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Our Charge

- ▶ How do we take all we have learned in the past two days to improve reduced-form integrated assessment models (IAMs)?
- ▶ In which sectors or categories has research on physical impacts of climate change or methods for valuing the associated damages developed beyond what is currently represented in reduced-form IAMs? Which of these can most readily be incorporated into modified versions of existing IAMs? How could one approach modeling the interactions across individual impact sectors?
- ▶ From the perspective of your discipline/area of expertise (e.g. economist, scientist, IAM modeler), what are the most important gaps or uncertainties in our knowledge regarding the impacts of climate change and associated economic damages? What research would be most useful in the near vs. long term?

The Short Version of My Answers

- ▶ How do we take all we have learned in the past two days to improve reduced-form integrated assessment models (IAMs)?
- ▶ Many different possibilities, but not clear to me that it's always a good idea.
- ▶ In which sectors or categories has research on physical impacts of climate change or methods for valuing the associated damages developed beyond what is currently represented in reduced-form IAMs?
- ▶ Pretty much all of them with respect to physical impacts. Methods for economic valuation appear at first glance not to have advanced nearly as much. Methods for incorporating valuation and physical impacts into reduced form models are increasingly sophisticated, but we need to be careful about what either the data or the models are capable of doing.
- ▶ Which of these can most readily be incorporated into modified versions of existing IAMs?
- ▶ Relatively few, without some fairly extensive thought given to thresholds, non-linear behavior, and process-level understanding.
- ▶ How could one approach modeling the interactions across individual impact sectors?
- ▶ Need explicit representation of the sectors and both the economic and physical factors (e.g. competition for water and land) that connect them.
- ▶ From the perspective of your discipline/area of expertise (e.g. economist, scientist, IAM modeler), what are the most important gaps or uncertainties in our knowledge regarding the impacts of climate change and associated economic damages? What research would be most useful in the near vs. long term?
- ▶ See below

Background

- ▶ The challenge to all the modelers in the workshop has essentially been framed in a “social cost of carbon” framework
- ▶ Assumes that we have good central estimates of a large number of parameters, both physical and economic, but is this reasonable?
- ▶ Many reasons in particular cases that we should be humble about our ability to generate really good estimates, so I will highlight only a few...

Background

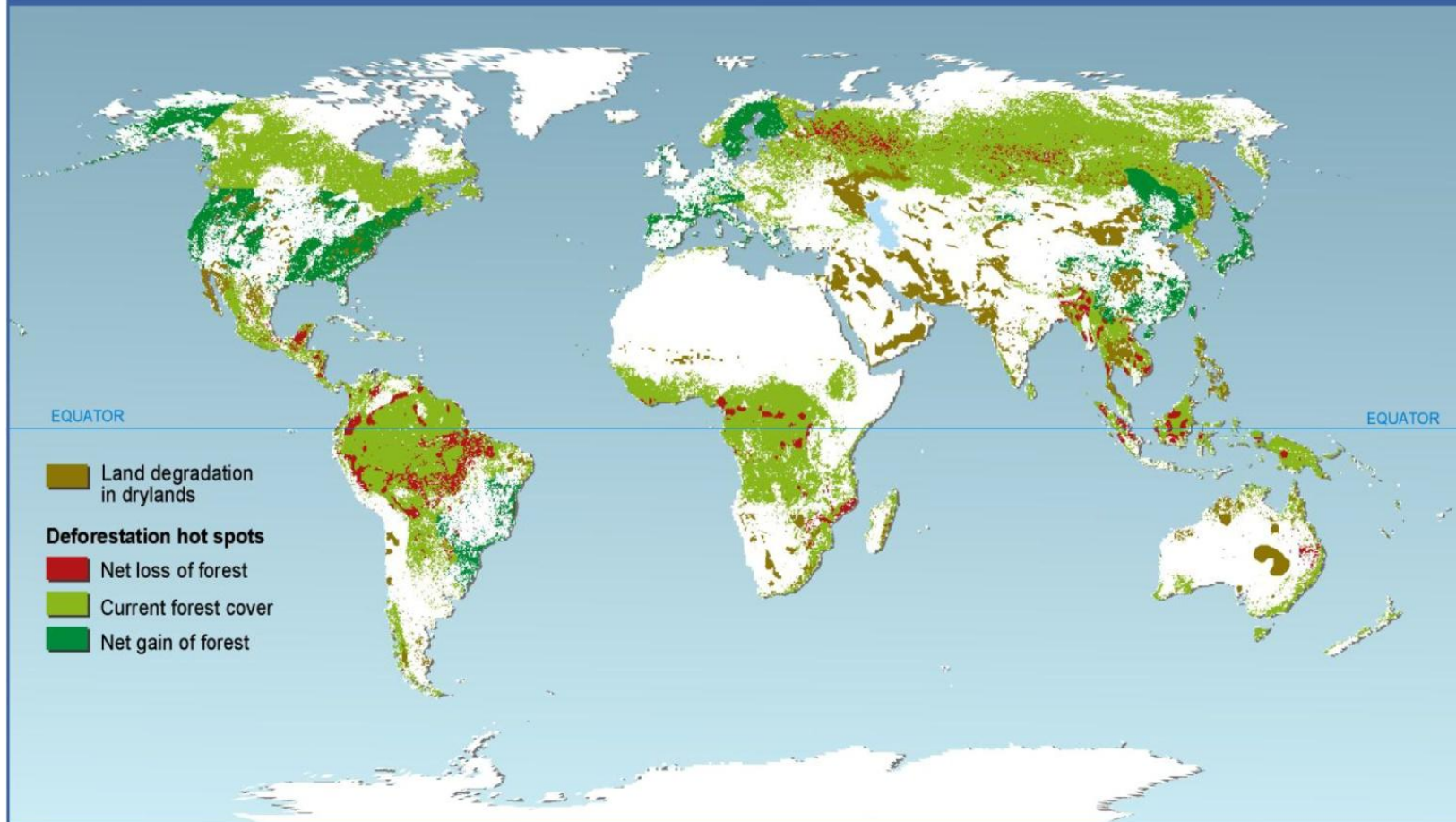
- ▶ Ubiquity of “bad behavior” in physical systems
- ▶ Thresholds are routine phenomena– we’ve looked at much of the literature on ecological thresholds, and in some ways the greater challenge is finding a system that does not respond in this way
- ▶ But our ability to model such changes is rudimentary – yesterday, saw the example of the sensitivity of crop productivity to temperature thresholds, many other examples where there is an ecosystem threshold that is not necessarily related to an extreme in climate variability...



Background

- ▶ The major drivers of big changes over the past half-century in both managed and unmanaged ecosystems are in fact human-driven
- ▶ Land-cover changes as just one example
- ▶ We need to be able to take these sort of changes into account; heard this point made in a very interesting talk on forests this morning

Forest Cover and Land Degradation Change from 1980-2000

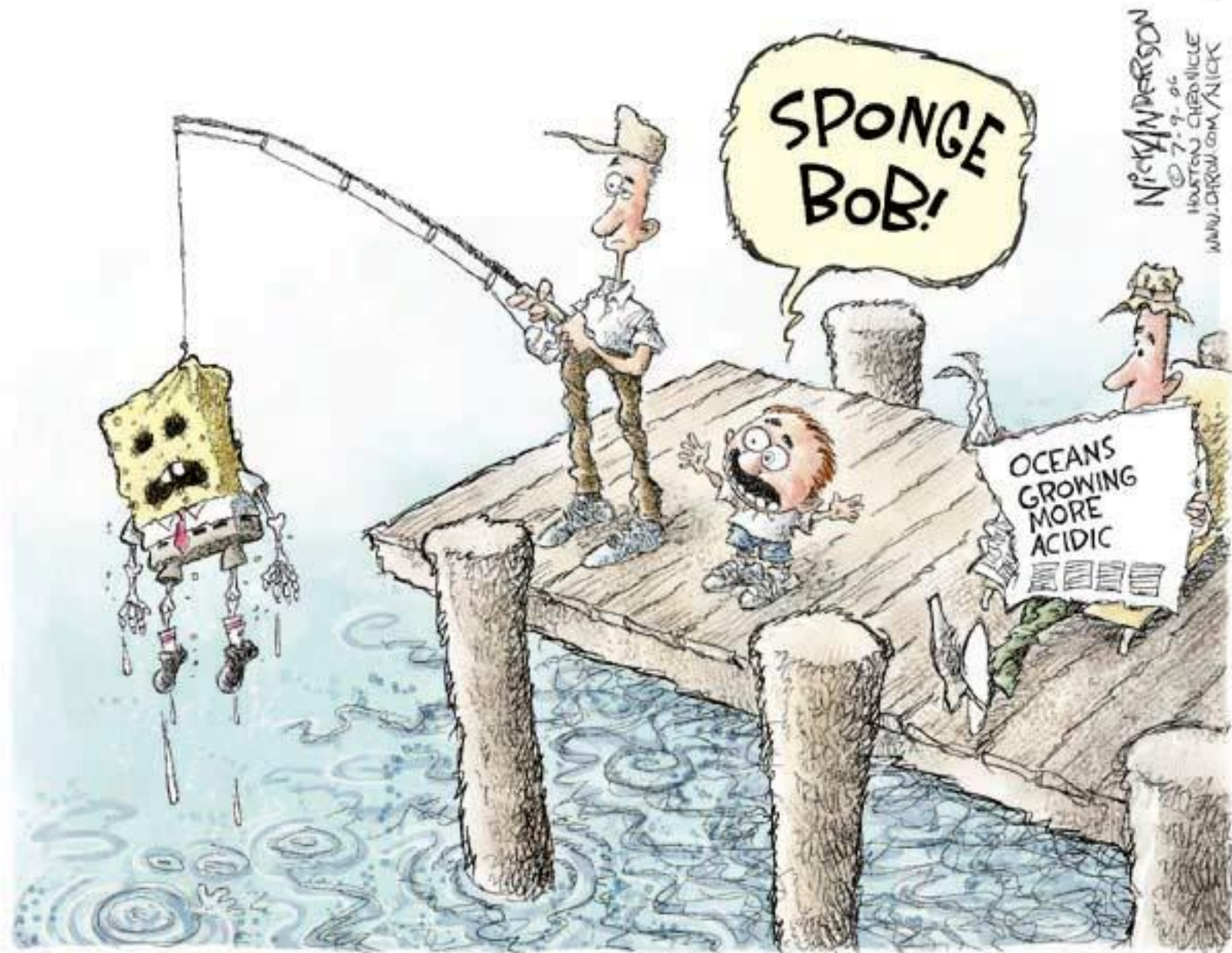


Background

- ▶ Interaction among sectors is clearly a first-order problem, not a second-order problem as we have typically treated it in impact assessments
- ▶ Competition for water among agricultural, energy, industrial and other human uses – and ecosystem uses/needs is just the tip of the iceberg
- ▶ Competition for land among economically productive uses (e.g. agriculture, forestry), provision of ecosystem services that are not valued in markets, provision of services that are not currently valued in markets, but could be in different policy regimes
- ▶ Aggregation/disaggregation issues turn out to be extremely important, and this is a challenge for the response-surface approach

Background

- ▶ Many of the ecological models that are being used have well-known deficiencies that are not being taken into account
 - They do a quite poor job of parameterizing the CO₂-driven increases in water-use efficiency, for example
 - They typically do not include the type of threshold responses mentioned before
 - They underplay or don't include biotic interactions like pests and pathogens
 - Some, including the DGVM's, are essentially unverified, and how they could be verified is not all that clear
- ▶ Some of the potential ecological changes are still in the category of being theoretically possible, but our techniques for projecting them are very preliminary (e.g. extinction risk, climate envelope modeling for range shifts)



Background

- ▶ The technique of inferring or developing simple, statistically- or model-based response functions for use in reduced form IAMs faces some very difficult challenges
- ▶ My personal conclusion is that these techniques have utility for understanding some of the interactions of climate impacts and economic concerns in today's world – AND THIS IS REALLY IMPORTANT TO DO!
- ▶ But their ability to do projections that are intrinsically far beyond the range in which the original parameterizations and damage functions have been developed is likely to be quite limited
- ▶ My second conclusion is that a more process-based approach to linking concerns about impacts with their economic consequences and with the economic and technological evolution of both the impact sectors and climate policy is more likely to be helpful at the end of the day
- ▶ But such research also must be humbly done – with careful attention to how well we know the underlying processes, and extensive exploration of where the uncertainties are...